

REMARKS

This paper is being provided in response to the August 22, 2003 Office Action for the above-referenced application.

The rejection of claims 1-3 and 9-11 under 35 U.S.C. §103(a) as being obvious over U.S. Patent No. 5,783,917 (hereinafter referred to as "Takekawa") in view of U.S. Patent No. 4,246,518 (hereinafter referred to as "Kogler") is hereby traversed and reconsideration thereof is respectfully requested. Applicants respectfully submit that the claims are patentable over the cited references.

Claim 1 recites a method of starting a brushless DC motor including an armature coil in a stator and field magnets in a rotor. The method comprises selecting a first starting waveform from a plurality of stored waveforms, supplying a starting current having the selected first starting waveform for said armature coil while said rotor is in a stationary state, measuring an induced voltage induced in the armature coil by rotation of the rotor, wherein the rotation is caused by the starting current, and supplying a drive current for the armature coil in response to the induced voltage.

Claims 2-3 depend from claim 1 and recite further patentable features over the base claim. Dependent claim 2 recites that supplying the drive current includes determining a position of the rotor based on the induced voltage, and deciding the drive current based on the determined position. Dependent claim 3 recites that the induced voltage is measured after the starting current is supplied.

Claim 9 recites a brushless DC motor, comprising an armature including an armature coil, a rotor including a plurality of field magnets, a power supply unit arranged to supply current to the armature coil, and a measuring unit. The power supply unit supplies a starting current for said armature coil while said rotor is in a stationary state, and the measuring unit measures an induced voltage induced in the armature coil by rotation of the rotor, the rotation being caused by

the starting current. The starting current has a waveform selected from a plurality of stored waveforms. The power supply unit supplies a drive current for the armature coil in response to the induced voltage.

Claims 10-11 depend from claim 9 and recite further patentable features over the base claim. Dependent claim 10 recites that the power supply determines a position of the rotor based on the induced voltage, and decides the drive current based on the determined position. Dependent claim 11 recites that the induced voltage is measured after the starting current is supplied.

Takekawa discloses a DC brushless motor that runs in a synchronous mode upon startup, and switches to a position feedback system after a fixed time (see col 6, line 51 – col 7, line 15). In synchronous mode, power is delivered to the motor coils according to a fixed, predetermined schedule, without using a feedback sensor. The fixed time is selected to be long enough to assure that the motor has started in synchronous mode and is running at a sufficiently high speed that its position can be detected (col. 7, lines 5-10).

Kogler discloses a DC brushless motor that may be operated in a stepping mode. Two Hall effect sensors (H1, H2) determine the position of the rotor (within one of four quadrants). One of four phase windings (W1, W2, W3, W4) may be energized to move the rotor from one quadrant to the next. A selection circuit (5) uses the two Hall effect sensors to determine which phase winding to energize in order to move the rotor into the next quadrant. This signal is held in a storage element (2) until it is sent to the commutator by clocking the storage element.

Applicants respectfully submit that independent claims 1 and 9 are not obvious over Takekawa in view of Kogler. In particular, neither Takekawa nor Kogler discloses selecting a *starting current waveform* from a *plurality of stored waveforms*.

According to Takekawa, the coils are simply energized in a single fixed pattern for a period of time long enough to ensure that the rotor is turning. No plurality of stored waveforms is disclosed. This defect is not remedied by Kogler. Kogler does not describe storing a *plurality*

of waveforms, but only describes a memory temporarily holding a two-bit signal indicating which phase winding is to be energized next. Kogler specifically discloses that when the motor is started, the memory is cleared and the rotor is moved to a predetermined starting position (col. 5, lines 53-57). Thus, it does not disclose selecting a *starting current* from a plurality of waveforms.

Since independent claims 1 and 9 are not obvious over Takekawa in view of Kogler, dependent claims 2-3 and 10-11 also cannot be obvious over this combination. For at least the reasons described above, Applicant requests that the rejection be reconsidered and withdrawn.

The rejection of claims 1, 2, 4, 9, 10 and 12 under 35 U.S.C. §103(a) as being obvious over U.S. Patent No. 5,245,256 (hereinafter referred to as “Cassat”) in view of Kogler is hereby traversed and reconsideration thereof is respectfully requested. Applicants respectfully submit that the claims are patentable over the cited references.

Claims 1, 2, 9, and 10 are as discussed above. Claims 4 and 12 depend from claims 1 and 9, respectively, and recite further the patentable feature over the base claims, that the induced voltage is measured after the starting current is applied.

Kogler is as discussed above. Cassat discloses a brushless DC motor that uses excitation current and back EMF to control the speed of the motor after startup. The motor must be started and accelerated to a nominal speed before the invention of Cassat can operate; Cassat does not describe a startup method (see col. 7, lines 61-66).

Applicants respectfully submit that independent claims 1 and 9 are not obvious over Cassat in view of Kogler. As discussed above, Kogler does not describe selecting a *starting current* from a plurality of waveforms, as recited by claims 1 and 9. This defect is not remedied by Cassat, which does not describe a startup method at all.

Since independent claims 1 and 9 are not obvious over Cassat in view of Kogler, dependent claims 2, 4, 10 and 12 also cannot be obvious over this combination. For at least the reasons described above, Applicant requests that the rejection be reconsidered and withdrawn.

The rejection of claims 1, 5-7, 9, and 13-15 under 35 U.S.C. §103(a) as being obvious over U.S. Patent No. 5,744,921 (hereinafter referred to as “Makaran”) in view of Kogler is hereby traversed and reconsideration thereof is respectfully requested. Applicants respectfully submit that the claims are patentable over the cited references.

Claims 1 and 9 are as discussed above. Claims 5-7 depend from claim 1, and recite further patentable features over the base claim. Dependent claim 5 recites that a second starting waveform is selected from the plurality of waveforms, and is used to start the motor if the first waveform does not result in rotation of the rotor. Claim 6 recites that the direction of rotation of the motor after startup is detected, and the rotor is stopped if it is rotating in the wrong direction. Claim 7 recites that during a first phase, the motor is controlled using induced voltage, until it reaches a predetermined speed. During a second phase subsequent to the first phase, the motor is controlled using the rotor speed.

Claims 13-15 depend from claim 9, and recite further patentable features over the base claim. Dependent claim 13 recites that a second starting waveform is selected from the plurality of waveforms, and is used to start the motor if the first waveform does not result in rotation of the rotor. Claim 14 recites that the direction of rotation of the motor after startup is detected, and the rotor is stopped if it is rotating in the wrong direction. Claim 15 recites that the motor is initially controlled using induced voltage. After the motor has reached a predetermined speed, the motor is controlled using the rotor speed.

Kogler is as discussed above. Makaran discloses a control circuit for a five-phase brushless DC motor. The rotor is started from a standstill using a predetermined sequence of energization of the motor windings (col. 8, lines 27-46). If the rotor is already rotating in the wrong direction at startup, the rotor is stopped at a predetermined position, where a known

sequence of currents can be used to start the motor in the correct direction (col. 8, lines 13-26; Fig. 4).

Applicants respectfully submit that independent claims 1 and 9 are not obvious over Makaran in view of Kogler. There is no suggestion or teaching in Makaran of selecting a waveform for the starting current from a plurality of stored waveforms, as recited by both independent claims. Instead, Makaran uses a predetermined single sequence to start the rotor. This defect is not remedied by Kogler. As discussed above, Kogler does not describe or suggest selecting a waveform for the starting current from a plurality of stored waveforms, but also starts the motor from a predetermined position.

Since independent claims 1 and 9 are not obvious over Makaran in view of Kogler, dependent claims 5-7 and 13-15 also cannot be obvious over this combination. For at least the reasons described above, Applicant requests that the rejection be reconsidered and withdrawn.

The rejection of claims 8 and 16 under 35 U.S.C. §103(a) as being obvious over Makaran in view of Kogler is hereby traversed and reconsideration thereof is respectfully requested. Applicants respectfully submit that the claims are patentable over the cited references.

Claims 8 and 16 depend from independent claims 1 and 9 (discussed above) respectively, and recite the further patentable feature over the base claims, that during a first phase, the drive current is selected to turn the rotor with maximum torque. In a subsequent second phase after the rotor speed reaches a predetermined value, the current flow duration of the drive current is controlled based on the rotor speed.

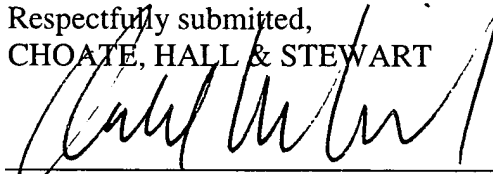
Kogler and Makaran are as discussed above.

Applicants respectfully submit that claims 8 and 16 are not obvious over Makaran in view of Kogler. As discussed above, both Makaran and Kogler describe a motor that is started from a predetermined single sequence. The references do not teach or suggest, either singly or in combination, the selection of a starting waveform from a plurality of stored waveforms, as

required by independent claims 1 and 9, from which claims 8 and 16 depend. Thus, claims 8 and 16 cannot be rendered obvious by this combination.

Based on the above, Applicants respectfully request that the Examiner reconsider and withdraw all outstanding rejections and objections. Favorable consideration and allowance are earnestly solicited. Should there be any questions after reviewing this paper, the Examiner is invited to contact the undersigned at 617-248-4038.

Respectfully submitted,
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